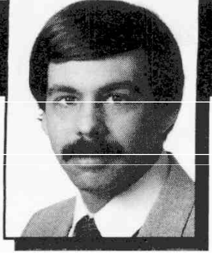

Finishers' Think Tank

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Chromates on Zinc Alloy Deposits

Q. We barrel-plate zinc-nickel alloy deposits on steel automotive parts, and we noted that the yellow chromate deposits in unusual colors. What causes the colors and how can we correct it?

A. First of all, when you go to an alloy deposit, you arc making a departure from conventional zinc plating. The rationale for utilizing an alloy deposit is that you get a better, more corrosion-resistant coating on the parts being processed. This is a fictional finish, not a decorative one. In North America, the practice of form-over- function has developed into a mania that may not be appropriate to justify the requirements of the job.

Chromates on zinc alloy deposits do not look the same as those on pure zinc coatings. The main reason for the difference is the concentration, as well as the distribution, of the alloying material in the deposit. In zinc-nickel deposits, the distribution-and the overall concentration of the nickel in the deposit —depends on many variables. The gross concentration of nickel in the solution, the temperature of the process solution, the agitation of the barrel, the current density applied to the parts, the shape and size of the parts and the position in the barrel, are only a few of the more significant factors.

When the chromate is applied, the chromate solution dissolves the surface of the deposit somewhat, and further changes the concentration of the nickel that the chromate solution comes in contact with. Differences that you see in the color of the chromate directly correspond to the alloy that the chromate encounters. As you can discern from the description of the deposit variables, it will be difficult to predict what colors will be present in the chromate film. Furthermore, the colors will be many and varied on the part, in random patterns, and the patterns may not be current-density-associated.

The ultimate arbiter of the quality of the chromate deposit is the corrosion-resistant response that the chromates give. If your parts are meeting the quality corrosion specifications that you are aiming for, then the chromates should be classified as being proper. The use of quality imperatives for chromate color, as associated with zinc plating, may not be appropriate to measure the chromates on alloy systems. Alloy system chromates exhibit deep reds, as well as greens and blues, which are not characteristic to zinc deposits but are normal for zinc alloy deposits.

Electroless Nickel On Copper-based Alloys

Q. We need to deposit electroless nickel onto copper-based alloys. What cycles should we follow?

A. Electroless nickel (EN), also called autoeatalytic nickel, is deposited by a chemically driven reaction that must be catalyzed if the surface of the part is to be plated. Metals that are catalytic to EN include most iron alloys, nickel, and aluminum, among others. Metals that are *not* catalytic to EN include lead, copper alloys and others. Because copper is not a catalytic surface for EN, it must first be coated with a catalytic material, or with a material that will cause the surface to become catalytic. This is usually accomplished by making the parts cathodic in the EN bath using a stainless steel or nickel anode, which will cause the electrolytic reduction of nickel metal onto the surface. Because the electrolytic nickel coating is catalytic to the chemical reduction reaction, plating will occur, catalyzed by the nickel-coated surface.

Another method available is the sensitization of the surface of the copper part with a material that will cause the chemical reduction of the nickel at the surface. Palladium chloride, in a solution of hydrochloric acid, will sensitize the surface of the copper part being processed. This will cause the reduction of nickel onto the surface of the part and will allow further deposition by the autocatalytic EN process. The use of palladium to initiate EN on the surface is quite common in the manufacture of printed circuit boards (PCBs), where it is necessary to have deposition occur only on the areas coated with copper and not on the plastic associated with the boards. The copper on PCBs is infinitely more sensitive to activation by palladium than the plastic, and plating should occur just in the intended areas.

The use of palladium activation of a copper surface has become more popular in recent years because:

- the quality of the EN coatings by the use of the palladium activator is superior,
- adhesion is improved, and
- the EN deposits more uniformly and with a better grain structure.

The quality of the initial deposit with EN is paramount, and the use of activators improves that all-important first coating. The activators also allow plating over poor areas of the part, such as 90-degree angles, as well as over solders and areas affected by soldering flux. A down-side of using activators on copper substrates is that, if they are carried over to the plating bath, they will cause degeneration of the solution. For this reason, the cycle must be well-thought-out and the proper number of rinses must be used between the process tanks.

Shop Talk from Marty

Initiating a Metal Finishing Shop's Pollution Prevention Program

What is the true cost of creating a waste? This is a very elusive idea to contemplate and evaluate, because the impact is on many levels. If you create a waste, then you are disposing of materials that you have paid to be brought into your plant-"lost resources" is not good business.

When looking at waste costs, try to include all the essential ingredients of what is being created as waste. Pollution prevention imperatives call for the preservation of company resources when processing materials. Looking at costs is a valid method of identifying pollution prevention opportunities. Waste costs may include:

- Cost of poor quality
- Cost of contentious hazardous materials
- Cost of excess or disposed-of raw materials
- Cost of handling waste materials
- Cost of labor associated with waste
- Cost of executive time associated with waste
- Cost of transportation of waste
- Cost of final disposal of waste
- Cost of time associated with handling/addressing waste
- Cost of company resources
- Cost of insurance
- Cost of energy associated with waste

Let's address one of the most obvious components of a production process: *Quality!* If your process system produces poor quality, you are spending company resources to create unmarketable junk. You cannot sell the junk you make, and you spend the same amount of company resources on raw materials to produce more waste when your product is not up to quality standards. And, on top of all that, you probably will need to strip and reprocess the parts, which represents more lost resources and more waste for each of the poor-quality parts you create.

A valid way of measuring waste produced is by per-part processed. In doing such an appraisal, you will be surprised what it translates to in terms of costs associated with your process. A company that produces parts from a plating line with a 95-percent quality throughput produces at least five percent rejects.

The first step, therefore, in beginning a pollution prevention program is to audit and examine your production. Measure your throughput and try to assign a cost associated with products produced, so that you can directly determine the cost associated with poor quality. Finally, calculate the extra profit that would occur if you produced better quality work. This cost of quality is directly related to the first step in your pollution prevention ethic-other costs associated with waste-per-part processed will become more and more apparent. •